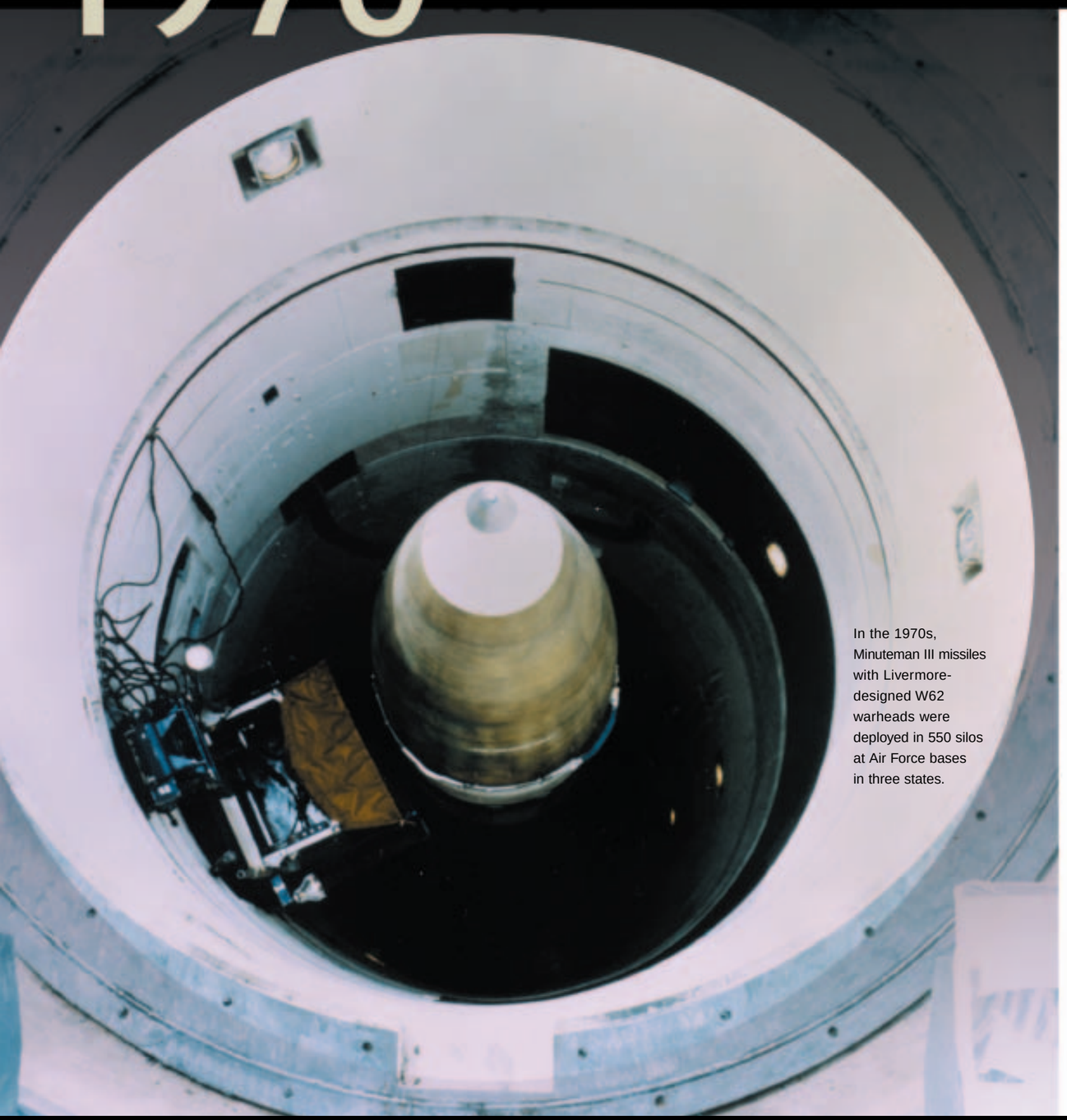

In the 1970s, Minuteman III missiles with Livermore-designed W62 warheads were deployed in 550 silos at Air Force bases in three states.

Multiple Warheads Increase Missile Effectiveness

In 1970, the United States introduced a new capability that dramatically increased the effectiveness of its land- and sea-based strategic missile forces. Both the Minuteman III intercontinental ballistic missile and the Poseidon C-3 submarine-launched ballistic missile were deployed with multiple independently targeted reentry vehicles (MIRVs), a technology that allowed each missile to attack multiple targets within a large "footprint." This provided considerable flexibility in targeting. MIRVs also were more cost-effective because they leveraged the large costs of missile silos and submarines. The warheads for each of these missile systems were designed by Livermore. The W62 warhead for Minuteman III (deployed in April 1970) and the W68 warhead for C-3 (deployed in June 1970) pushed the envelope of yield-to-weight ratio, a key to the MIRV concept. They were also the first designs to include a comprehensive set of hardening features for protection against antiballistic missile (ABM) defenses. The warheads were the product of an extremely fruitful period in weapon development at the Laboratory during the 1960s.

The MIRV concept resulted from the convergence of missile technology improvements, concerns about Soviet work on ABM systems, and the desire for improved accuracy. Early in the development of Minuteman III, it became clear that a liquid-fueled fourth stage was needed for higher delivery accuracy. Further consideration led to the concept of using additional fuel in the fourth stage to independently target multiple RVs and penetration aids. Meanwhile, the ability of missile systems to deploy individual satellites through use of a post-boost control system had been demonstrated in the U.S. space program in October 1963. In December 1964, Secretary of Defense Robert McNamara approved development of a MIRV system for Minuteman III. By early 1965, the Navy's Strategic Systems Project Office had developed baseline design requirements for the C-3 missile that would include MIRV capability.

Livermore received the assignment for both systems, and each program faced significant design challenges. The requirement to put 14 vehicles on the relatively small C-3 platform was very stressing. The W68 (in the Mk3 reentry body) was the smallest strategic warhead ever deployed by the U.S. The accuracy requirement for the Mk12, which carried the W62, led to a vehicle design that placed stringent volume limitations on the warhead, and the yield had to be sufficient for attacking hardened missile silos. In addition, both warheads included special hardening features intended to improve survivability when penetrating a threat antiballistic missile system. These features were developed with the aid of an extensive series of "exposure" nuclear tests conducted in conjunction with the Defense Nuclear Agency.

When the first MIRV systems were deployed more than 30 years ago, they marked the end to a chapter in which Livermore and the military redefined the strategic missile posture of the United States. The W62 and W68 represented such a dramatic advance in the state of nuclear design that all subsequent missile system warheads have incorporated many of their key elements. Their extensive development programs, conducted in close coordination with the Air Force and Navy and their contractors, were a model for all subsequent generations of delivery-system design teams.

The Poseidon C-3 missile launched from a submerged submarine.